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ARGUING TO CONVINCE

THE RHETORIC OF SCIENTIFIC DISCOURSE

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This paper deals with scientific discourse as a rhetorical discourse from the point of view of the structure of the classical parts of oral discourse (and all kinds of discourse). The role of argumentation in discourse, with the perlocutionary goal of convincing the receiver, is studied as the foundation of the rhetorical nature of scientific discourse. A scientific treatise by Santiago Ramón y Cajal is analysed using the tools provided by rhetoric in order to prove the rhetorical nature of scientific discourse. The main contribution of this paper is to establish the crucial role of argumentation in scientific discourse and to demonstrate its permeation of the entire discourse.

Keywords: rhetoric, rhetorical extension, rhetorical discourse, scientific discourse, argumentation.

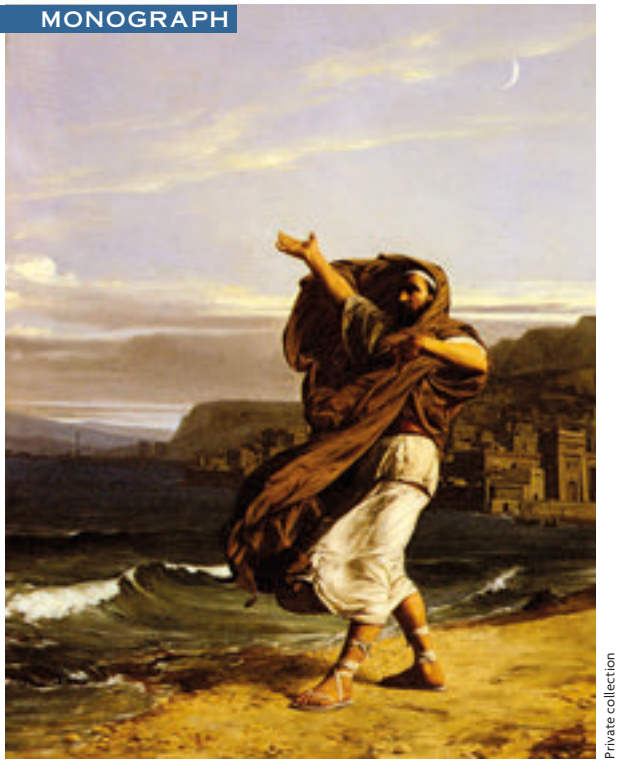
THE EXPANSION OF RHETORIC AS A DISCIPLINE

It is well known that rhetoric was born in Sicily as a tool for communication within courts of justice in the field of civil law. Nevertheless, rhetoric was not restricted in its early development to that particular area of law, but extended to criminal law with a steady expansion in the types of speeches that were produced and studied. Thus, if we consider the rhetorical genres proposed by Anaximenes of Lampsacus and by Aristotle (1971), rhetoric took its first steps into the realm of a communicative praxis in the forensic genre, where the speeches from which the receivers decide about past events are situated; afterwards, it passed to the communicative space of the deliberative genre, concerning the receivers' decision about future events (as in political speeches) and to the communicative space of the demonstrative genre, whose speeches are not judged by the receivers, although they do evaluate the ideas that are proposed and judge the communicative abilities of the orator. Starting from oration, rhetoric dealt with literature, where the devices of expressivity, the figures and tropes, are very important. From orality, rhetoric spread to writing and to every kind of discourse – including the metacomunicative, as with translation (Chico Rico, 2015) –, whatever the channel and is currently linked to digital discourse, without abandoning any of the former spaces. In this way, it is important in rhetoric to recover the historical thinking proposed by García Berrio (1984). Despite its birth and development within the field of law, rhetoric maintained a close relationship with pedagogy, psychology and politics since its early days. Rhetoric was formed as the technique of efficient communication (Quintilian, 1970) and has proved useful in all kinds of communication, both in discursive production and in its analysis. Therefore, rhetoric has connected with disciplines with which it had not formerly maintained a relationship, like economics, anthropology, biology, physics, etc. It is these relationships that complete the linking of rhetoric with scientific discourse.

> «RHETORIC WAS BORN IN SICILY AS A TOOL FOR COMMUNICATION IN COURTS IN THE AREA OF CIVIL LAW»

RHETORIC AND SCIENTIFIC DISCOURSE

The word *science* comes from the Latin *scientia*, which means knowledge, so the current tendency to exclusively identify the word *science* with one of the different sciences (human sciences, social sciences, natural sciences, exact sciences, etc.) could in principle be considered contrary not only to etymology but also to the present meaning of the word. The first definition of *science* in Spanish in the *Diccionario*



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From its first steps, rhetoric, born and established within the realm of law, maintained a close relationship with pedagogy, psychology and political science. The picture shows the painting *Demosthenes practicing oratory* (1870), by the French artist Jean-Jules-Antoine Lecomte du Nouÿ (oil on canvas, 37.5 × 47.3 cm).

de la Real Academia is «body of knowledge obtained through observation and reasoning, structured systematically and from which principles and general laws are deduced» (Real Academia Española, 2014). Hence, referring to scientific discourse means dealing with the discourse of any science. Nevertheless, it is possible to consider the discourse of natural sciences, of mathematical sciences, of health sciences, as representative of scientific discourse, since they contain and display the structures and devices of the different scientific discourses with extraordinary intensity.

One of the keys of the methodological appropriateness (both for production and analysis) of rhetoric for scientific discourse is the role of argumentation (Marraud, 2007) as one of its essential components. It is necessary for rhetorical discourse to contain argumentation, i.e., motivation, justification of its approaches and proposals. Hence, rhetoric is a technique and a science which requires wherefores. Rhetorical discourses – every rhetorical discourse, not only scientific – must have an argumentative support based upon laws, history, literature, reasoning and experimentation.

«RHETORIC HAS PROVED USEFUL IN ALL KINDS OF COMMUNICATION, BOTH IN DISCURSIVE PRODUCTION AND ITS ANALYSIS»

THE PARTS OF RHETORICAL SPEECH AND THEIR PROJECTION ONTO SCIENTIFIC DISCOURSE

Classical rhetoric provided the *partes orationis*, the parts of speech, primarily for judicial speech, but these also function in the discourse of other rhetorical genres, the deliberative and the demonstrative genres, the latter of which is the genre of scientific discourse. The *partes orationis* organise the relationship between the discourse and the referent it expresses. They join the syntactic semiotic dimension of rhetorical discourse and its extensional-semantic or referential dimension, that of the actual or imaginary reality represented by the textual construction (Albaladejo, 1988-1989). All this is dynamically embedded in the pragmatic, communicative framework, where the producer of discourse attempts to act perlocutionarily on the receivers by influencing them with persuasion and/or conviction. Rhetorical discourse is organised towards the persuasive/convincing goal thanks to its parts; all of which are subordinated to the global construction of discourse, which aims for a perlocutionary effect on the receivers (listeners, readers).

The parts of rhetorical speech are introduction, narration, argumentation and peroration. Argumentation is divided into proof and refutation (Lausberg, 1966-1968; Pujante, 2003). The introduction is the presentation of the topic to be dealt with, but also of the producer and the circumstances or motives of his or her communicative intention in constructing the communication (be it oral or written). The narration is the statement of facts dealt with in the discourse. The argumentation is the discursive support (with proof, examples, quotations of authority, enthymemes and epicheiremes as forms of rhetorical reasoning, etc.) for the thesis or theses defended in the discourse, with argumentation taking the form of proof, and against other theses with which the producer disagrees, taking the form of refutation. Lastly, the peroration is the final part of discourse, where the producer offers a summary by way of a synthesis of the main issues dealt with in the discourse and proposes that the receivers support his or her thesis or theses.

The *partes orationis* are parts of a whole and act jointly in the service of discourse and its perlocutionary goal. All parts are important, each one fulfils its function in the discourse and supports the other parts. No part would make sense by itself if the others were absent. It is a dynamic framework of discourse both

in its constructive dimension and its referential one. Although the rhetorical weight falls upon all parts of the discourse, argumentation is no doubt the central part, the core of rhetoric and of any discourse.

All parts of rhetorical discourse are projected onto scientific discourse inasmuch as this is also a rhetorical discourse, having a rhetorical framework that is equivalent to that of the *partes orationis*, serving the perlocutionary action on the receiver in order to convince him or her about the scientific theses that are proposed and are rhetorically supported (by means of argumentation) by the producer of the discourse. Scientific discourse, as the discourse of all sciences and, consequently, the discourse of natural, mathematical and health sciences, is a rhetorical discourse. By virtue of its extension, rhetoric, as explained above, transformed itself into a technique of written communication without forgoing its interest in oral communication. This extension placed rhetoric in the realm of written discourse, of essay and, of course, of scientific essay. The essay *Las sensaciones de las hormigas* ("The sensations of ants") by Santiago Ramón y Cajal, in which the Navarrese scientist deals with the psychology of ants, is a discourse of this kind.

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In his essay, Santiago Ramón y Cajal referred to the researchers who studied ants before he did. He mentioned Jean Henri Fabre (above), who devoted his life to the study of insects.

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Since it is a rhetorical discourse, Ramón y Cajal's essay possesses the framework of the *partes orationis* with some peculiarities that are addressed to intensify the perlocutionary effect, scientific discourse's goal of convincing. Thus, the introduction of this essay allows its producer or author to introduce his own discourse explaining the motives for its creation and publication, in other words, for its composition and delivery, to introduce the topic to be dealt with, and add an element of humbleness to the essay:

> Kindly urged by Don Ignacio Bolívar, revered and wise master of all Spanish naturalists – pushed aside from the university lecture room by the tyranny of law in full intellectual vigour, though at least not from teaching –, I write these pages, a poor offering with which I want to help to celebrate the fiftieth anniversary of the Spanish Society of Natural History, one of the most patriotic, tireless and altruistic scientific Corporations to make our country proud.
>
> This brief and disjointed contribution constitutes – it goes without saying – an unripe fruit, prematurely taken from the tree, still in the nursery, of my investigations on the psychology of ants.
>
> (Ramón y Cajal, 1921)

The introduction fulfils an essential function since it orients the receivers about the motives, topic and circumstances of the scientific discourse. It predisposes the attention of the receivers, who begin to activate their interpretative devices when they know the topic. It is necessary to stress the metadiscursive nature of the introduction.

The narration is another discursive element that is completely functional in the rhetorical framework. The state of affairs is part of this *pars orationis*. Ramón y Cajal presents a broad narrative, beginning with a general exposition about the preceding research carried out on the topic of his essay:

> The topic of the tropisms, sensory data, perceptions, associative memory, reflex action, superior instinct, etc., of this compelling category of Hymenoptera have been studied by a numerous army of enlightened researchers, among which – and these are only the latest ones – we must mention the names of Lubbock, Fabre, Forel, André, Turner, Bethe, Ziegler, Santschi, Bonnier, Bohm, Piéron, Cornetz, Bouvier, etc.
>
> Any new-coming observer in a very explored domain, before starting his personal work, is forced to repeat, test and discuss the data and experiments of his predecessors. I am still, unfortunately, in the first stage of the process. Instead of adding to the corpus published by so many illustrious wise men, I am obliged to point out what is true, as far as my humble mind can know, among the new and disputed. Therefore my very ungrateful work will be not to finish, but to refine; and to do so without being certain it will work: so many and so varied are the causes

of mistakes that distort our reason when thinking about such delicate problems.

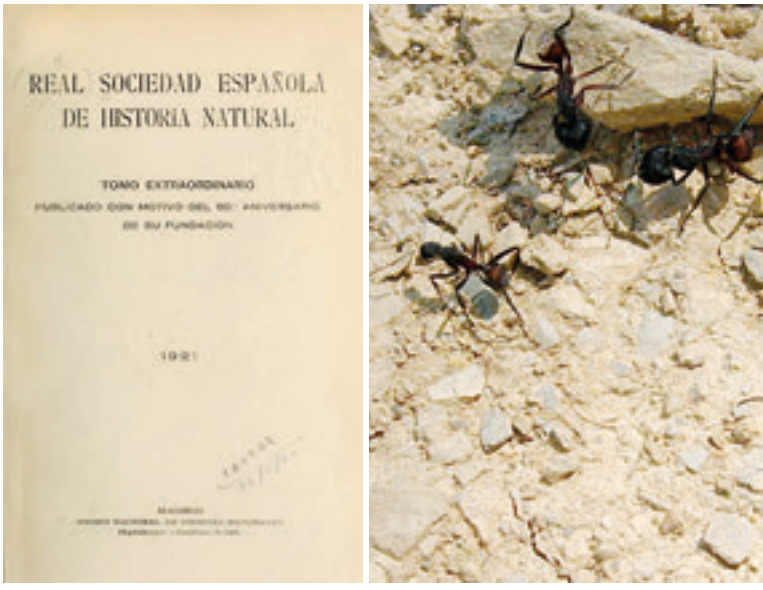
(Ramón y Cajal, 1921)

The narration, like the introduction, serves the perlocutionary goal: both parts of this scientific discourse are oriented to convince the receivers and to achieve this goal it is necessary to report on the research accomplished by other scientists and to take a stance on them, in addition to showing the writer's own experience of the subject under discussion.

Frequently, narration is intermingled with elements of argumentation, which are proposed together with pieces of information on the state of affairs. It is possible to find this in the scientific discourse *Las sensaciones de las hormigas* ("The sensations of ants"). It also occurs in rhetorical discourses of a political nature. Argumentation is no doubt the most important *pars orationis* in scientific discourse (Ordóñez, 1998; Pera, 1991; Zamora Bonilla, 2006), where the producer must argue for his theses and against the theses he does not agree with by activating the proof and the refutation in the dialectical dimension of rhetorical discourse. Argumentation is a connection point between rhetoric and science (Salvador Liern, 2008) because of the clarifying function of scientific language (Hernández Guerrero & García Tejera, 2004). The dialectical nature of the rhetorical argumentation can be observed in the following passage from Ramón y Cajal's essay, which contains refutation:

> Supposed perception of colours, defended by the thorough Sir Lubbock and other observers, is far from being proved. Strictly speaking, what can be deduced from the patient and clever experiments of the wise Englishman is not that *F. fusca* and *Lasius niger* qualitatively discriminate colours, but that those ants are affected, as a photographic plate, by the briefest radiation on the spectrum, i.e., by those with the highest photo-chemical strength.
>
> On the other hand, the anatomy of ants' eyes, with limited sight, work against Lubbock's opinion. Even though our work on this matter is far from being completed, due to the enormous difficulty to obtain thin, well-dyed sections of the ocular system, all our preparations of the eye of the soldier *Aphaenogaster*, *Camponotus cruentatus*, etc. show, immediately behind highly biconvex corneas, a compact and continuous layer of brown-black pigment that absorbs spectral radiation.
>
> (Ramón y Cajal, 1921)

The dimension of proof of the argumentation is present in the essay, as it must be. Experimentation has an argumentative role of great strength for the perlocutionary goal of convincing receivers. The



Santiago Ramón y Cajal wrote the essay *Las sensaciones de las hormigas* ("The sensations of ants") to celebrate the fiftieth anniversary of the Spanish Society of Natural History. On the left, a special volume that collected many scientific works to commemorate the date. Centred, several specimens of *Camponotus cruentatus*, one of the species studied by the scientist from Navarra (on the right) in his essay, where he captured his observations on the anatomy of ant eyes.

author of *Las sensaciones de las hormigas* uses experiments as argumentative elements:

> Let us now cite some experiments that, in our opinion, prove that oligovisual ants lack colour perception.
>
> Let us start by saying that these hymenoptera do not show the least sign of surprise or astonishment when, coming back from their excursions, they find the tracks or openings of their nest dyed intensely with different colours of aniline, provided that they are completely dry. Indifference is also observed when sunlight is projected or sifted through a coloured prism in front of them.
>
> (Ramón y Cajal, 1921)

As a rhetorical discourse, scientific discourse cannot lack the peroration, the conclusion, which includes capturing the emotional receptors which is the key action of perlocutionary discourse. The peroration of Ramón y Cajal's essay contains this passage, which concludes the discourse:

> It is very educational to compare, in this sense, the lucid and complex industrial instincts of almost blind ants with the poor mentality of those insects, like flies, dragonflies or butterflies, who have magnificent eyes, exquisite smell and touch and powerful flight. One could say that Nature, being aware of its own injustice, is pleased to bestow all the gifts of the soul to the most

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> humble beings, devoid equally of strength, beauty and grace.
>
> (Ramón y Cajal, 1921)

What is clear from the examination of the scientific discourse is the central role that argumentation plays as a *pars orationis* throughout the whole discourse, impregnating other parts, not only the aforementioned intermingling of narrative and argument, but also playing a role in the introduction and the peroration which tend to be somewhat argumentative.

Metaphors (Arduini, 2007) serve the perlocutionary function and are subordinated to the cross-discursive and global status of argumentation in rhetorical discourse. They increase the communicative yield of discourse. For example, Ramón y Cajal uses metaphor in his introduction in order to show the immature state of his research in the field of the subject of the essay, since it is at an initial phase: «unripe fruit, prematurely taken from the tree, still in the nursery» (Ramón y Cajal, 1921).

CONCLUSION

The central role of argumentation in scientific discourse is one of the bases of it being a rhetorical discourse. As to the need for argumentation, it is necessary to take into account its cultural nature, since a scientific discourse with a weak argumentation or none at all would not be accepted in the culture of scientific communication, since it is expected to contribute to the perlocutionary goal of discourse. This is the reason why scientific discourse is an object of cultural rhetoric (Albaladejo, 2013).

The presence of argumentation in scientific discourse contributes to its rational nature. However, scientific discourse can contain irrational, affective elements, as can be seen in the peroration of Ramón y Cajal's essay.

«SCIENTIFIC DISCOURSE CAN CONTAIN IRRATIONAL, AFFECTIVE ELEMENTS, AS CAN BE SEEN IN THE PERORATION OF RAMÓN Y CAJAL'S ESSAY»

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